BROADCAST ®
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PROBLEM SOLVED

Installation and Operation Manual

SS 2.1 MLR/RJ
RJ45 Audio Switcher/Router with Mechanical Latching Relays

Manual update: 5/14/2020
If you need a firmware upgrade, contact Broadcast Tools®

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e-mail: support@broadcasttools.com   **voice:** 360.854.9559   **fax:** 866.783.1742

INTRODUCTION

Thank you for your purchase of a Broadcast Tools® SS 2.1 MLR/RJ transparent two input, dual output switcher/router (referred to as the SS 2.1 MLR/RJ throughout this manual). We are confident that this product will give you many years of dependable service. This manual is intended to give you all the information needed to install and operate the Broadcast Tools® SS 2.1 MLR/RJ.

SAFETY INFORMATION

Only qualified technical personnel should install the SS 2.1 MLR/RJ. Any attempt to install this device by a person who is not technically qualified could result in a hazardous condition to the installer or other personnel or damage to the SS 2.1 MLR/RJ or other equipment. Please ensure that proper safety precautions have been taken before installing this device. If you are unfamiliar with this type of equipment, please contact a properly qualified engineer to handle the installation and setup of the SS 2.1 MLR/RJ. Broadcast Tools, Inc., is unable to support NON-Broadcast Tools software, hardware, or NON-Broadcast Tools computer/hardware/software problems. If you experience these problems, please research your hardware/software instruction manuals, or contact the manufacturers technical support department.

WHO TO CONTACT FOR HELP

If you have any questions regarding your product or you need assistance, please contact your distributor from whom you purchased this equipment. If you would like more information about BROADCAST TOOLS® products, you may reach us at:

Broadcast Tools, Inc.
131 State Street
Sedro-Woolley, WA 98284-1503 USA
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Internet Home Page: www.broadcasttools.com
E-mail:support@broadcasttools.com

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Designed, Assembled and Supported in WA State, USA

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Broadcast Tools® Products, as with any electronic device, can fail without warning. Do not use this product in applications where a life threatening condition could result due to failure.
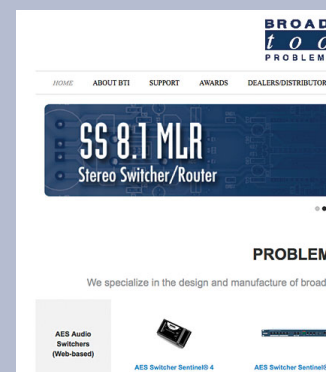
NOTE:

This manual should be read thoroughly before installation and operation.

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INTRODUCTION

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Product Overview

The SS 2.1 MLR/RJ is a transparent two input, one output RJ45 audio switcher/router with mechanical latching relays. The SS 2.1 MLR/RJ is perfect for all types of passive signal switching via front panel switches, contact closures and/or RS-232 serial. The switching is accomplished with mechanical latching gold contact relays, which means that the unit can route a signal in either direction. Due to the passive nature of the switching, any input level and impedance can be used. Inputs may be balanced or unbalanced, while output levels, impedance, distortion, noise, and balancing will match that of the selected input. The SS 2.1 MLR/RJ can be controlled and monitored locally and/or with simple contact closures to ground, as well with multi-drop RS-232 serial commands.

Features/Benefits

• Front panel input channel selection push buttons with active channel LED indicators.
• Front panel "Mute" switch, with LED indicator, to turn off all audio to the output.
• Front panel "Enable" switch, with LED indicator, can be configured to provide a safety lock to the front panel selection push buttons.
• Remote control via contact closures, 5-volt TTL/CMOS logic levels and/or the multi-drop RS-232 serial port.
• Two SPDT relay outputs for remote channel status.
• Internal silence sensor with front panel LED indicator; separate SPST silence sensor alarm relay, adjustable alarm delay and restore duration.
• Audio/signal switching via mechanical latching sealed relays utilizing 2-form-C bifurcated - crossbar silver alloy with gold overlay contacts.
• Two shielded RJ45 audio input jacks and one shielded RJ45 audio output jack.
• Removable euro-block screw terminal connectors are used for remote control connections. Necessary mating plugs are supplied.
• The power-up source selection feature allows the user to select which source is active at power up, including the last source selected.
• If power is lost, the last selected channel's signal is passed to the output.
• Fully RFI proofed.
• Surge protected internal power supply, universal switching power supply with domestic connector supplied. International power supply optional.
• Up to three units may be mounted on the optional RA-1 rack shelf. Desktop and wall mounting are also possible.

Applications

Switching/routing applications include: Analog and/or AES audio sources, Studio selection, Audio processing selection, EAS audio insertion, RS-232, RS-422 or RS-485 data signals and telephone lines.

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OVERVIEW

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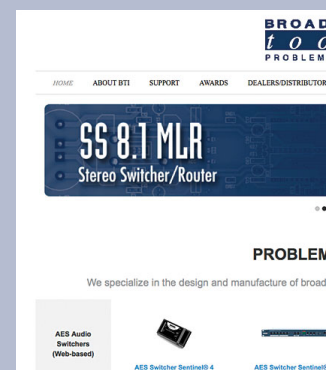
Inspection

Please examine your SS 2.1 MLR/RJ carefully for any damage that may have been sustained during shipping. If any damage is present, please notify the shipper immediately and retain the packaging for inspection by the shipper. The package should contain the SS 2.1 MLR/RJ, a RJ11 modular cable with 9-pin "S9" female D-sub adapter, and a 9 to 12 VDC power supply. Manuals may be downloaded from our web site.

Installation

Surge Protection

The SS 2.1 MLR/RJ has built-in resistance to voltage changes; we recommend that you use a power surge protector or line conditioner on the incoming AC line. Lightning strikes and/or other high voltage surges may damage your SS 2.1 MLR/RJ and connected equipment if it is not properly protected. For lightning protection devices, check out www.polyphaser.com and www.itwlinx.com.

UPS Standby Power System

We recommend that you connect your SS 2.1 MLR/RJ to a UPS system. A UPS helps minimize the risk to the SS 2.1 MLR/RJ and provides power during a power outage.

NOTE: If power is lost, the last selected input channel's signal will continue to be passively routed to the output.

Installation/Operation

Input selection push buttons

Each input and mute can be selected via its front panel push button labelled "1", "2", and "Mute" respectively. Each input push button has an associated LED indicator which will illuminate when the channel is selected. When a channel is selected, the previous channel is deselected (interlock). The enable (safety) push button can be enabled to require the user to hold down the enable push button while selecting any of the other front panel push buttons, the enable LED is illuminated when this function is enabled, see page 8 for more information.

LED indicators

- "PWR" LED: Illuminates when power is applied and blinks when serial data is active. (Green)
- "Enable" LED: Illuminates when the front panel enable push button is enabled. (Green)
- "SS" LED: Illuminates when output silence is detected (SS), if enabled. (Yellow)
- Channel ("1" & "2") LED illuminates when the input channel is selected. (Green)
- "Mute" LED illuminate when output is muted. (Red)
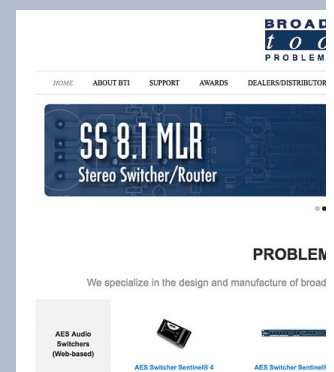
Power

Connect the 2.1mm barrel type power connector into the unit and the center-positive 9 to 12 VDC domestic power supply into a 120 Vac 50-60 Hz power source. Never use any type of powersupply other than the specified/supplied power supply.

Chassis Ground screw (CHS GND): The #6-32 sized chassis ground screw should be tied to the station (house) or system ground.

I/O and Remote Control Connectors

The rear panel contains all of the inputs, outputs, and remote-control connections. Audio input and output connections are made via shielded RJ45 jacks and the remote-control connections are made through pluggable screw terminals with mating connectors. The multi-drop serial port uses a modular RJ-11 jack.

RJ45 Audio Inputs and Outputs

Input 1 RJ45 (J15)	Input 2 RJ45 (J16)	Output RJ45 (J17)

Input sources that are NOT selected are terminated with 10K ohm resistors. If you do not require this load applied to the deselected sources, they may be removed, or a different value may be substituted for each channel. Each channel has a pair of resistors: channel 1 = R1 & R2, channel 2 = R3 & R4.

If you are using the SS 2.1 MLR/RJ for applications other than switching analog audio, the Silence Sensor should be disabled. To disable, remove the resistor network RP2 from its socket.

RJ45 Audio Input and Output Pinout:

Please use shielded twisted pair Cat5e or Cat6 cables and connectors (STP) with the input and output RJ45 audio jacks.

RJ45 Pinout:

Function:	Wire Pair:	RJ45 Pins:
Left+/AES+	White/Orange	1
Left-/AES-	Orange/White	2
Right+	White/Green	3
Right -	Green/White	6
n/c	White/Blue	5
DC GND	Blue/White	4
n/c	White/Brown	7
n/c	Brown/White	8
Sig. Shield	Shield	Connector Shield

OPERATION
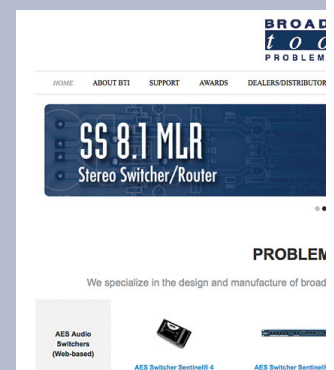
Remote Control Wiring

The SS 2.1 MLR/RJ interfaces with external equipment through two 6-position removable euroblock screw terminals. The terminals accommodate wire sizes from 16 - 28 AWG solid or stranded wire. Before installing a wire, remove the euroblock screw terminal plug and turn each capture screw fully counterclockwise. Strip each conductor to a length of 0.25" and insert the conductor fully into the terminal. Turn the capture screw fully clockwise to secure the conductor.

The remote-control connections to the switcher are labelled SW-1 (Input 1), SW-2 (Input 2), SW-3 (Mute) on the bottom row of the connector TB-1. Each channel may be selected by a momentary or sustained (depending on the configuration) contact to ground. Each channel is internally pulled high (5-volts) through a 22K resistor.

Relays

SPDT relay contacts are available on the top row of the remote-control connector (TB-1) and pins 5-6 of the bottom row remote control connector. The relay K3 is closed when with input channel one is selected, K4 is closed when input channel two is selected, and relay K5 (SPST) is closed when silence is detected (if enabled).

Note: For wiring information, refer to the grid below, silk-screen text on the rear panel of the product or the fractional schematic(s) in the appendix.

Relay Outputs (Top Row, TB-1)

K3 N.O.	K3 Common	K3 N.C.	K4 N.O.	K4 Common	K4 N.C.
SW-1	SW-2	SW-3	GND	K5 N.O./N.C.	K5 Common
(Input 1)	(Input 2)	(Mute)		(SS)	(SS)

Control Inputs (Bottom Row, TB-1)

RS-232 Serial Port (RJ-11 Jack):

This RJ-11 jack is used to connect the SS 2.1 MLR/RJ to a computer's COM port for RS-232 serial operation using the included reverse modular cable with 9-pin "S9" female D-sub adapter.

NOTE: *If your PC does not have a built-in RS-232 serial port but does have USB, then a USB-to-serial adapter cable is a good way to add serial capability. We recommend USB-to-serial adapter cables that use the FTDI chipset and have had good results with the model "SBT-FTDI" from Sabrent.*
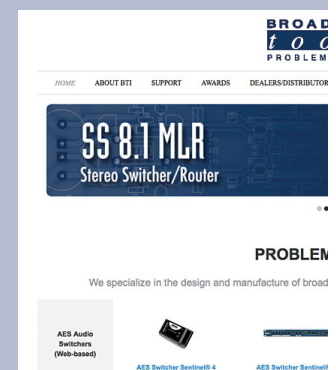
CAUTION!

Installation of the SS 2.1 MLR/RJ in high RF environments should be performed with care. The station ground should be connected to the designated chassis ground terminal using a 20 to 24-gauge wire.

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Configuration

Configuration Jumpers

JP3:   N.O. = Configures relay K5 (SS/Silence Sense) to Normally Open. (Factory Default)
        N.C. = Configures relay K5 (SS/Silence Sense) to Normally Closed.

JP4:   Disabled =Front panel enable switch defeated. (Factory Default)
        Enabled = Front panel ENABLE push button active. The enable LED is illuminated.

NOTE: With JP4 enabled the enable push button must be held on/closed to operate any of the other front panel push buttons, this does not affect the remote-control functions.

Configuration DIP-switch Setup (SW5)

Follow the tables below for configuration options.

Unit ID	SW5-1	SW5-2
ID 0 *	OFF	OFF
ID 1	ON	OFF
ID 2	OFF	ON
ID 3	ON	ON

Baud Rate	SW5-3	SW5-4
2400	ON	OFF
9600*	OFF	OFF
19200	OFF	ON
38400	ON	ON

Power Up	SW5-5
User selected	ON
Last source selected*	OFF

Note: *To select an input at power-up with SW5-5 ON, hold down the push-button for the desired input channel or mute until the front panel LED's flash.

Remote Control Operation Modes	SW5-6	SW5-7
Normal *	OFF	OFF
Sustained	ON	OFF
EAS/MSRP	OFF	ON
Toggle	ON	ON

- Normal operation mode: Pulse 1-IN to select channel 1, Pulse IN-2 to select channel 2, or pulse the "M-IN" (mute) pin to turn off both channels.
- Sustained operation mode: Hold IN-2 low to select channel 2. Release In-2 to switch back to channel 1.
- EAS/MSRP operation mode: See Sage ENDEC EAS Installation Guidelines section of this manual.
- Toggle operation mode: Alternately pulse 1-IN to select between the two channels.

Note: After changing any dipswitch, please repower the unit.
Note: * Denotes factory setting.

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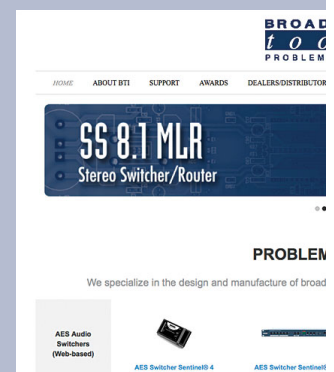
CONFIGURATION

Sage ENDEC EAS Installation Guidelines/MSRP Mode
The SS 2.1 MLR/RJ can be set to a special Multi-Station Relay Panel (MSRP) EAS switcher emulation mode which enables it to receive the serial control commands sent by the Sage Digital ENDEC EAS system. You can operate up to four independent stations from one Sage Digital ENDEC by using one SS 2.1 MLR/RJ per station.

To use the SS2.1 MLR/RJ in EAS switcher mode with an ENDEC you must set the DIP switch SW-5 for the proper unit ID, station ID, and mode of operation.

Unit ID	SW5-1	SW5-2
ID 0 *	OFF	OFF
ID 1	ON	OFF
Station ID	**SW5-3**	**SW5-4**
1*	OFF	OFF
2	ON	OFF
3	OFF	ON
4	ON	ON
Mode	**SW5-6**	**SW5-7**
EAS/MSRP	OFF	ON

* Denotes factory default setting.
Note: After changing any DIP switch, please re-power the unit.

Connecting a single SS 2.1 MLR/RJ to the Sage ENDEC serial port:
Attach the supplied "S9" DB-9 female adapter to a Sage ENDEC COM port configured for "Relay," 1200 baud, and the desired station ID. Connect the S9 modular cable to the RJ11 jack on the SS 2.1 MLR/RJ. Make sure SW-5 on the SS 2.1 MLR/RJ is configured according to the settings listed above.
Set the Sage ENDEC's MSRP settings.

Connecting two or more SS 2.1 MLR/RJs to the Sage ENDEC Serial Port:
Multiple SS 2.1 MLR/RJs may be cascaded serially to operate from the same serial port by assigning unique unit/station IDs to each SS 2.1 MLR/RJ.

Once the SS2.1 MLRs are configured properly they can be attached in parallel to the ENDEC using a duplex modular adapter such as the Allen-Tel AT202-6 in conjunction with the S9 adapter and reverse modular cables. Plug the male end of the duplex modular adapter into the supplied female "S9", DB-9 to RJ-11 adapter, then attach one end of the supplied reversed modular line cords into each of the duplex modular adapter receptacles and the other ends into each of the SS 2.1 MLR/RJ modular receptacles. Three or more SS 2.1's may be daisy chained by using the above description and a 5-jack modular adapter such as the Allen-Tel AT150.

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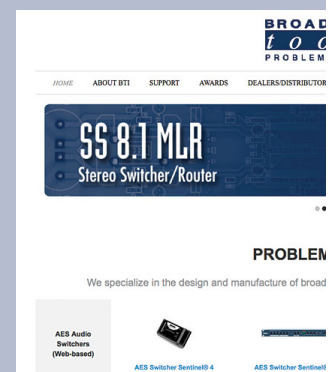
Serial Operation

RS-232 Serial Control
Connect the supplied reverse modular cable with 9-pin "S9" female D-sub adapter from the "RS-232" jack on the switcher to a RS-232 serial COM port on your PC.

Start a serial terminal application like Tera Term, PuTTY, or HyperTerminal configured for the COM port the SS 2.1 MLR/RJ is connected to at 9600 baud ,8, N,1 flow control to NONE, Emulation set to ANSI, and local character echo enabled.

"S9" female D-sub adapter pinout:

RJ-11 Adapter Pin	DB-9 D-SUB Pin #	Product's point of view Function Name.
4	3	RS-232 Receive
3	2	RS-232 Transmit
2	5	Ground

```
      | | | | | | |
      |_____|
      | 1 2 3 4
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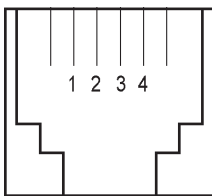
Modular Jack
Pin Numbers

Serial Commands
The switcher may be controlled and monitored by burst serial strings or by the embedded setup menu.

Where the   < * > Denotes start of string character
              < u > Unit ID (address, 0 through 3)
              < i > Input channel (1, 2 or M (MUTE)).

*ui   Switch to input i.
*uM   Mute audio output (Turn Off Audio)
*uSL   Send Audio Status: SuL1,x,x<cr><lf>
               Note: x: 0 = OFF / x: 1 = ON
*uSS   Send Silence Sensor Status: SuS,x<cr><lf>
               Note: x: 0 = not-silent / x: 1 = silent
*POLL   Display unit ID in appropriate time slot (0, 1, 2, or 3)..
*uU   Enter menu mode. Unit ID 0 only.

Examples: *02   This string turns input channel 2 on.
                  *0M   This string MUTEs the switcher's output.
                  *0U   Accesses the menu. (NOTE: The menu times out after 60 seconds of keyboard inactivity).
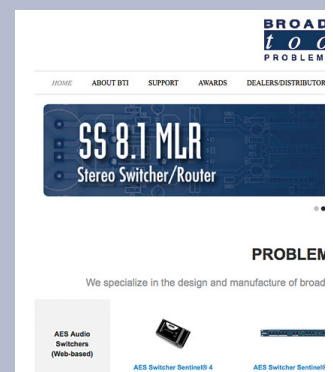
CONFIGURATION

Menu Operation

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Broadcast Tools(R) SS2.1MLR, v1.11 - Setup Menu

1 - Set Silence Sense Acquire Delay (sec) - Now:  10
2 - Set Silence Sense Restore Delay (sec) - Now:   2
3 - Set Silence Sense Threshold        - Now: OFF


S - Turn ON audio input
M - Turn OFF audio


V - Save Audio State for Power Up
C - Show Configuration and Status
F - Set Factory Defaults


Audio Status: Chan 1 On


Enter Selection, or Q to quit:
```

To enter menu mode send the command: *0u
To select a menu function, simply enter the letter on the left side of the menu and wait for the prompt.
Example: Type the letter S
Response: Enter Input Channel: Entering a 1 selects input channel one.

✏️ **NOTE:**

If your PC does not have a built-in RS-232 serial port but does have USB, then a USB-to-serial adapter cable is a good way to add serial capability. We recommend USB-to-serial adapter cables that use the FTDI chipset and have had good results with the model "SBT-FTDI" from Sabrent.

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CONFIGURATION

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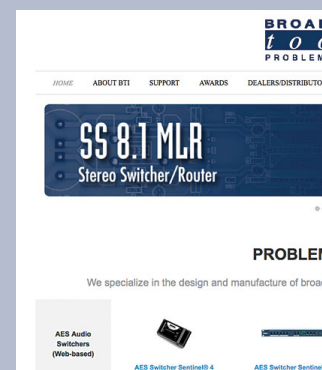
SPECIFICATIONS

Inputs/Outputs: Any input level and impedance can be used. Inputs may be balanced or unbalanced. Output levels, impedance, distortion, noise and balancing will match that of the selected input.

Switching Method: Passive. Mechanical latching sealed relays utilizing 2-form-C bifurcated-crossbar silver alloy with gold overlay contacts.

Logic: Flash microprocessor with non-volatile memory.

Operation Control: Front Panel: Momentary switches.
Remote: Momentary or sustained, compatible with 5 volts CMOS/TTL logic, open collector or contact closures to ground.
Serial: Multi-drop RS-232: 2400, 9600, 19200, 38400 baud, 8, N,1.

Status: Front Panel: LED Indicators.
Remote: Two SPDT status relays. One SPST Silence Sense relay. 1-amp @ 30 VDC max. Refer to the fractional schematic and/or text on the rear panel for connection details.

CAUTION! For safety, never connect 120 Vac circuits to the relays!

Interfacing: Audio I/O: Shielded RJ45 audio jacks.
Remote control: (2) 6-position pluggable screw terminal blocks, mating connectors supplied.
Serial: RJ-11 jack. Reversed RJ11 modular cable/female "S9" 9-pin D-Sub adapter cable supplied.

Power Requirements: 9 to 12 VDC @ >500 ma. 120 Vac 50-60hz power supply included. International power supply optional.

Physical Dimensions: 5.66" x 7.125" x 1.58", aluminum extrusion chassis with (4) #6-32 screw thread mounting holes for optional RA-1 rack shelf.

Weight: 2.0 lb.

Shipping Weight: 3.0 lb.

Options: RA-1 Rack Shelf. 1 RU. Accommodates up to 3 units, filler panels supplied. International power supply.

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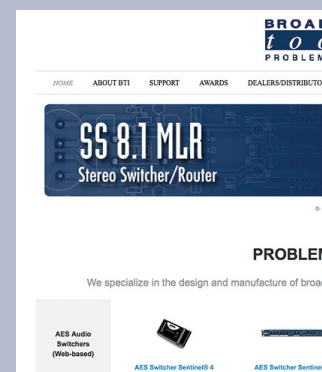
SPECIFICATIONS

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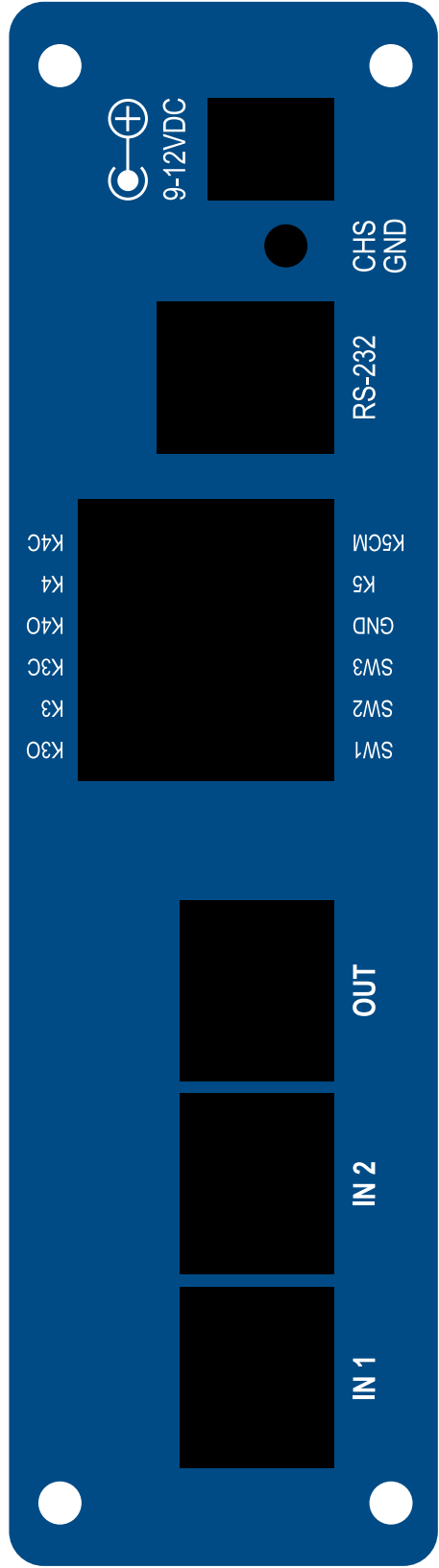
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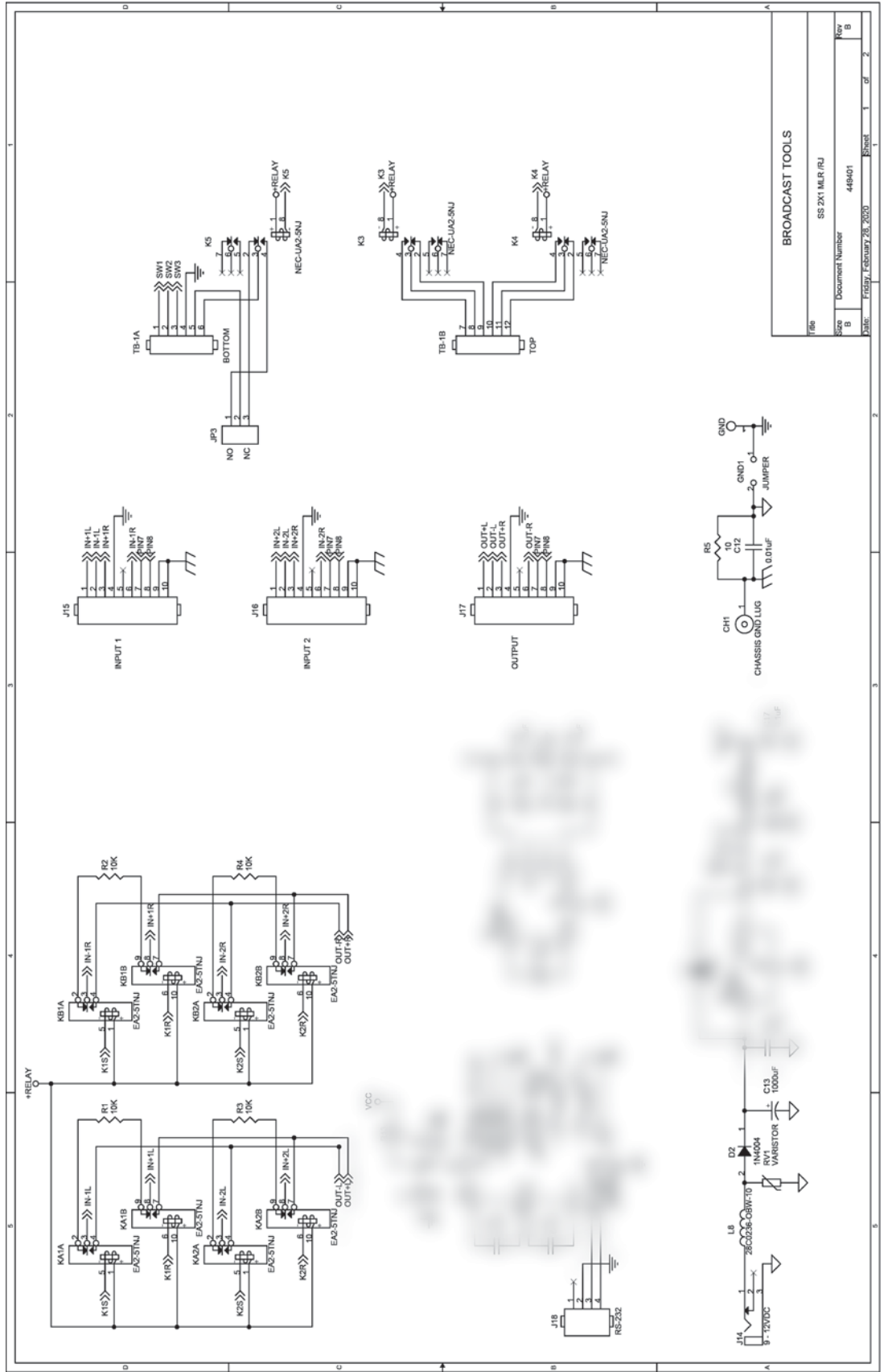
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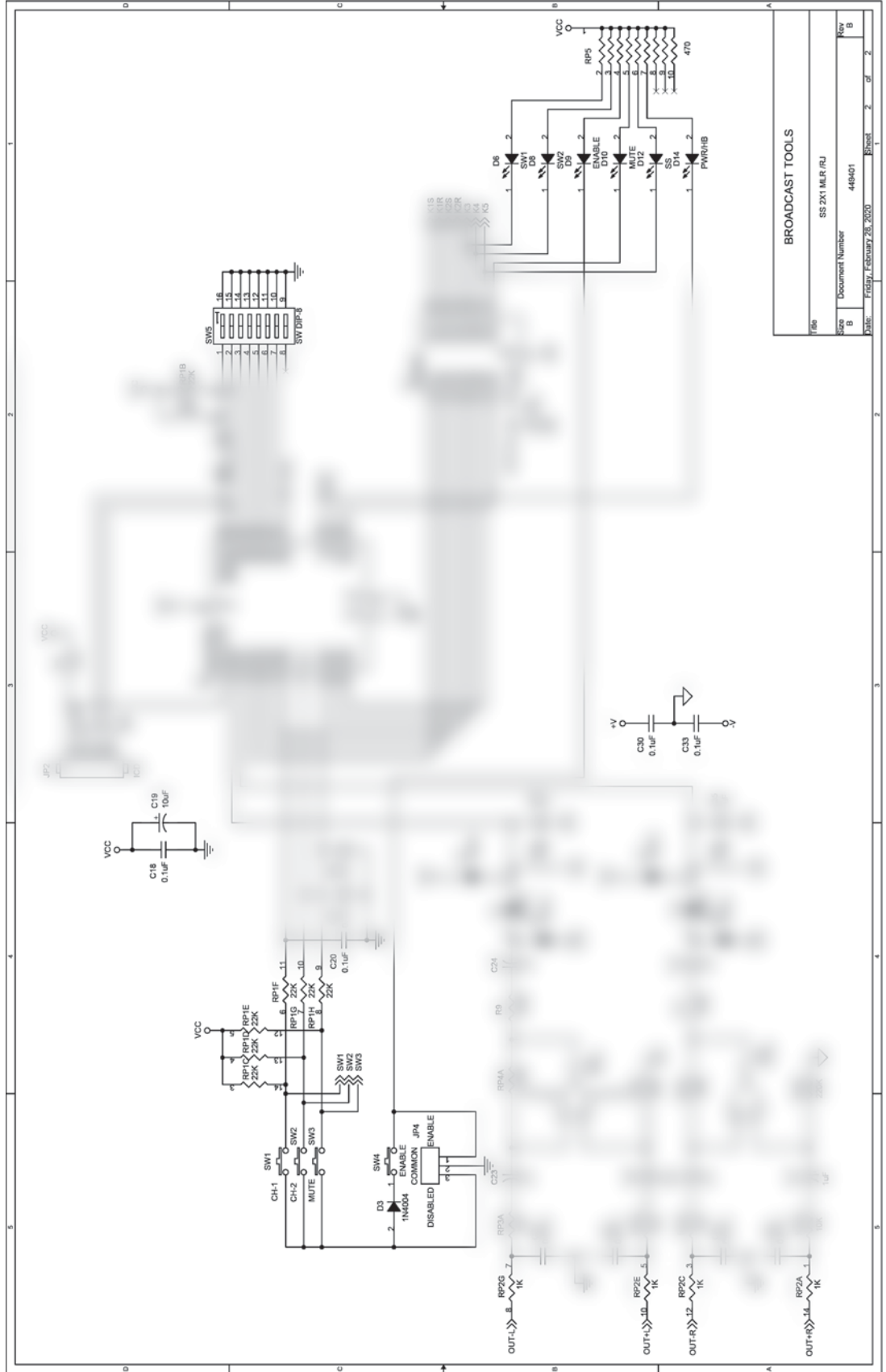www.broadcasttools.com **website**

BROADCAST tools®

SS 2.1 MLR Switcher/Router
w/ Mechanical Latching Relays

PWR/HB
SS
Mute
Mute
Enable
2
1

9-12VDC
CHS
GND
RS-232

K4C
K4
K4O
K3C
K3
K3O

K5CM
K5
GND
SW3
SW2
SW1

OUT
IN 2
IN 1

Fractional Schematic

Modified 03/09/20

Fractional Schematic

Component Layout

JP4: Front Panel
Enable Switch Jumper.
Default=Disable

SW5: Configuration
DIP-Switch

JP3: K5 Silence
Sensor Relay N.O./N.C.
Default=Normally Open

BROADCAST TOOLS
SS 2X1 MLR /RJ
449201 Rev B